Patent Claims

1. Method for the identification of Pupin coil [sic] interposed in a subscriber connection line, having the following steps:
transmission of periodic transmission symbols by a transmission device (2, 4, 5),
reception, sampling and further processing of an analog reception signal by a reception device (3, 6),
determination of the frequency response of the reception signal for a prescribed number of frequency points in a prescribed frequency range,
calculation of a function with function values ($F(f_i)$) from the real part and the imaginary part of the frequency response of the reception signal, and
determination of a differential vector (Δr_i) from the function values ($F(f_i)$) by a computing unit (11, 12, 13, 14, 15),
a criterion which specifies whether a pupinized line is present being derived from the components of the differential vector (Δr_i).

2. Method according to Claim 1,
characterized in that
a first partial vector ($r1$) and a second partial vector ($r2$) are formed from the function values ($F(f_i)$) by a function generator (12),
an intermediate vector ($P12 \cdot r2$) is determined from the second partial vector ($r2$) by a matrix multiplication device (13) and
the differential vector (Δr_i) is formed from the first partial vector ($r1$) and the intermediate vector ($P12 \cdot r2$) in a differential stage (15).

3. Method according to Claim 2,
characterized in that

the first partial vector ($r1$) comprises, as components, the function values ($F(f_i)$) with an even-numbered index and
the second partial vector ($r2$) comprises, as components, the function values ($F(f_i)$) with an odd-numbered index.

4. Method according to one of Claims 1 to 3, characterized in that
the criterion consists in the difference between a maximum value and a minimum value of the components of the differential vector ($criterion = \Delta r_{max} - \Delta r_{min}$) being compared with a differential prescribed value in a comparator device (14), and a signal being output if the difference is greater than the differential prescribed value.

5. Method according to one of Claims 1 to 3, characterized in that
the criterion consists in the sum of the absolute values of the components of the differential vector $criterion = \sum_i \Delta|r_i|$, being compared with a sum prescribed value in a comparator device (14), and a signal being output if the sum is greater than the sum prescribed value.

6. Method according to one of Claims 1 to 3, characterized in that
the criterion consists in the sum of the squares of the components of the differential vector ($criterion = \sum_i \Delta r_i^2$) being compared with a square sum prescribed value in a comparator device (14), and a signal being output if the sum is greater than the square sum prescribed value.

7. Method according to one of Claims 1 to 3, characterized in that

the criterion consists in the number of components of the differential vector (Δr_i) which are significantly different from zero being compared with a zero component prescribed value in a comparator device (14), and a signal being output if the sum is greater than the zero component prescribed value.

8. Method according to Claim 7, characterized in that, in order to determine the number of components of the differential vector (Δr_i) which are significantly different from zero, the coefficients are rounded and represented with a finite word length, the quantization size (word length) being chosen such that the values zero result for all the coefficients in the case of a non-pupinized line.

9. Method according to one of the preceding claims, characterized in that the prescribed frequency range lies between about 1 and 5 kHz.

10. Device for the identification of Pupin coil [sic] interposed in a subscriber connection line, having:
a transmission device (2, 4, 5) for the transmission of periodic transmission symbols,
a reception device (3, 6) for the reception, sampling and further processing of an analog reception signal, and
a computing unit (11, 12, 13, 14, 15) for:
determining the frequency response of the reception signal for a prescribed number of frequency points in a prescribed frequency range,
calculating a function with function values ($F(f_i)$) from the real part and the imaginary part of the frequency response of the reception signal, and

determining a differential vector (Δr_i) from the function values ($F(f_i)$),
a criterion which specifies whether a pupinized line is present being derived from the components of the differential vector (Δr_i).

11. Device according to Claim 10,
characterized in that
the computing unit (11, 12, 13, 14, 15) comprises
a function generator (12) for forming a first partial vector ($r1$) and a second partial vector ($r2$) from the function values ($F(f_i)$),
a matrix multiplication device (13) for determining an intermediate vector ($P12 \cdot r2$) from the second partial vector ($r2$)
and
a differential stage (15) for forming the differential vector (Δr_i) from the first partial vector ($r1$) and the intermediate vector ($P12 \cdot r2$).

12. Device according to either of Claims 10 and 11,
characterized in that
the computing unit (11, 12, 13, 14, 15) comprises a comparator device (14) for comparing the difference between a maximum value and a minimum value of the components of the differential vector ($criterion = \Delta r_{max} - \Delta r_{min}$) with a differential prescribed value and for outputting a signal if the difference is greater than the differential prescribed value.

13. Device according to either of Claims 10 and 11,
characterized in that
the computing unit (11, 12, 13, 14, 15) comprises a comparator device (14) for comparing the sum of the absolute values of the components of the differential vector ($criterion = \sum_i \Delta|r_i|,$) with a sum prescribed value and

for outputting a signal if the sum is greater than the sum prescribed value.

14. Device according to either of Claims 10 and 11, characterized in that
the computing unit (11, 12, 13, 14, 15) comprises a comparator device (14) for comparing the sum of the squares of the components of the differential vector ($criterion = \sum_i \Delta r_i^2$) with a square sum prescribed value and for outputting a signal if the sum is greater than the square sum prescribed value.

15. Device according to either of Claims 10 and 11, characterized in that
the computing unit (11, 12, 13, 14, 15) comprises a comparator device (14) for comparing the number of components of the differential vector which differ significantly from zero with a zero component prescribed value and for outputting a signal if the sum is greater than the zero component prescribed value.

16. Device according to one of Claims 10 to 15, characterized in that
the prescribed frequency range lies between about 1 and 5 kHz.